

# PATENT SPECIFICATION (11)

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## (54) AN APPARATUS FOR AND A METHOD OF PRINTING A WEB OF NON-WOVEN MATERIAL

(71) We, STORK BRABANT B.V., a Netherlands limited liability company, of 43a, Wim de Körverstraat, Boxmeer, the Netherlands, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an apparatus for printing a web of non-woven material provided with two or more driven rotary printing units, such as screen stencils or intaglio rollers, each of which co-operates with a respective support roller positioned opposite thereof, there being further provided a feeder for the material to be printed. An apparatus of this type for screen stencil printing is known from, among others, British Patent No. 1,488,857. The present invention also relates to a method of printing a web of non-woven material, particularly paper.

When printing a non-woven material the problem occurs of swelling of the material as a result of the absorption of moisture. This moisture emanates from the dyepaste or ink which in printing units is fed to the material. This swelling causes an increase of the web length coupled with a risk of the formation of wrinkles or folds, which phenomenon has of course to be avoided. A solution to this problem might be thought to consist of driving each subsequent printing unit at a somewhat higher speed for receiving the surplus length. Such a progressive driving speed cannot be realized, however, since the occurring increase of web length cannot be determined in advance.

The present invention in one aspect provides apparatus for printing a web of non-woven material provided with two or more driven rotary printing units each co-operating with a respective support roller positioned opposite thereof, and a feeder for the material to be printed, wherein the web of material is, during operation of the ap-

paratus, carried directly by the support rollers which are provided with a slip drive having a velocity which extends the circumferential velocity of the printing units by 0.5 to 1%.

As a result of the features of the apparatus according to the invention the support rollers are driven slippingly with excess speed with respect to the rotational velocity of the printing units so that in this manner the increase in length of the material between the consecutive printing units may be eliminated, with a minimum of tension of the web. In this connection it is important that printing is carried out in this manner without application of a customary supporting belt or blanket on which the material to be printed is mostly supported. In the apparatus according to the invention the web of material is supported and guided exclusively by direct contact with the support rollers. A further result of the slightly increased motion of the web of material is that an improved life span of the screen stencils is obtained, as described in U.S. Patent No. 3,420,167.

The difficulty of preventing the formation of folds or creases in the web of material can be further solved effectively if, in accordance with the invention, the zones of contact of successive support rollers with respective printing units constitute the bending points of a curved guide path of the web of material to be printed, which path is concave with respect to the rollers. The web, when passing each support roller, includes a small angle (for instance 10°), creating a repeated correction force in the web and simultaneously warranting a fold- and crease-free transport.

The apparatus as described hereinbefore may in particular be used in combination with a drying chest for the printed web of material. Especially when paper is printed an immediate drying thereof is essential for obtaining a first quality transfer paper, packing paper, wallpaper or any other product having a carrier consisting of a

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stable web-shaped material. The printing units may be accordingly preferably arranged in two paths extending generally vertically, the drying chest being arranged above these paths along a substantially horizontal web path.

Although printing in a vertical path is known, the combination described above occupies little floor space, while nevertheless a drying chest requiring much space may be utilized. The vertical printing path is also favourable for preventing the formation of wrinkles, folds or creases in the web.

The invention in another aspect provides a method of printing a web of non-woven material, by means of two or more stations each provided with a driven rotary printing unit; wherein the web of material in each printing station is supported directly by a respective driven support roller in which, via a slip drive, each said roller is given a circumferential velocity which exceeds the circumferential velocity of the respective printing units by 0.5 to 1%.

As a result of the features of the method according to the invention the increase in length of the material between successive printing units can be eliminated, with a minimum tension of a web of material to be printed.

The invention will be further described, by way of example only, with reference to the accompanying drawings, in which:

Fig. 1 schematically illustrates an apparatus according to the invention including an arrangement of a number of printing units arranged in a curved path; and

Fig. 2 shows a complete printing apparatus provided with two vertically arranged printing groups in combination with a drying chest.

The arrangement according to Fig. 1 comprises four driven printing units embodied as screen stencils 1-4, each of which co-operates closely with a support roller 4 positioned opposite the respective stencils. On the left-hand side of the apparatus, as shown in the drawing, there is a stock 6 of material to be printed, in this case a web of paper 7. Further, there is provided a pair of rollers 8, 9 for feeding the web of material 7. The web 7 is carried directly by the support rollers 5 which, together with the co-operating printing units 1-4, form the bending points of a guide path A of the web of material 7 to be printed. As can be clearly seen, the path A has a concave form with regard to the rollers 5.

The support rollers 5 are provided with a slip drive which is formed by an endless belt 10 with a drive 11. The belt 10 is slung over a part of the circumference of respective pulleys 12, each mounted adjacent a support roller 5. The belt 10 is also

guided along a number of rollers 13. The drive 11 of the endless belt 10 is coupled to the pair of rollers 8, 9 through a transmission 14.

When moistened, the non-woven web of material 7 tends to stretch, causing slack and subsequently the risk of the formation of folds or creases. In order to counteract this phenomenon the following measures are taken: through the slip-drive 10, 11 the support rollers 5 are driven at a velocity which exceeds the circumferential velocity of the stencils 1-4 by 0.5 to 1%, in practice by about 0.7%. The pair of rollers 8, 9 is likewise driven at a velocity slightly higher than that of the stencils 1-4, that is by about 0.1% to a maximum of 0.4%. The velocity of this pair of rollers 8, 9 is decisive for the travelling speed of the web material 7 and increases the span of life of the stencils 1-4 by preventing fluctuating forces at the location of the squeegee (U.S. Patent No. 3,420,167). As a result of the excess speed of the support rollers 5, stretch of the material, if any, in the web 7 between successive printing units can be eliminated, the web only having a minimum tension. The support rollers 5 co-operate directly with the underside of the web 7. The curved shape of the guide path A contributes to prevent the formation of folds and creases, since at the location of each printing unit the web 7 is guided along the matching support rollers 5 under a small angle.

Fig. 2 shows a complete machine for printing a web of paper in which two printing paths A1 and A2 are provided. These two paths, which extend generally vertically, are positioned on either side of a column 15 which is located on the left-hand side of the apparatus as shown in Fig. 2. Near the right-hand side there is another column 16 for accommodating means for the supply and discharge of the web 7. The two columns 15 and 16 support a drying chest 17 at a height of over 2 meters above the surface of the floor 18.

The printing path A1 comprises four intaglio rollers 19, whilst the printing path A2 is formed by four screen stencils 1-4 as described in Fig. 1. The intaglio-screen printing combination is known from the Applicant's earlier published Netherlands Patent Application No. 69 03989.

Hereby a universal machine is obtained by means of which any kind of printing can be carried out most efficiently. The arrangement of the two printing paths A1 and A2 on either side of the column 15 allows an easy access to all printing units, the drying chest 17 not being an inconvenient obstacle.

The column 16 is provided with rollers 130

20 for supplying the web 7 which emanates from a stock in a trestle 21. Further rollers 20 are arranged underneath the drying chest 17, so that the web 7 is guided to the path A2 of the first printing units constituted by the stencils 1-4. One or more of the printing units 1-4 may take an active part in the printing of the web 7, dependent on the nature of the final product desired. Via two rollers 20 arranged at the foot of the column 15, the web 7, after having passed the printing units 1-4, is guided to the printing path A1 wherein one or more intaglio rollers 19 may also be operative.

After having passed through the paths A2 and A1 the web 7 is conveyed to the drying chest 17 in which, by means of a strong current of heated dry air, the web is dried. Within the chest 17 a plurality of guide rollers 22 are so arranged that they form an upward convex curved path for the web 7. After the web 7 has left the drying chest, it is guided about a cooling drum 23 within the column 16 and is finally reeled in a trestle 25 via a number of guide rollers 24.

It is observed that in the paths A1 and A2 the same conditions are maintained as those described with regard to Fig. 1. In the upper side of the column 15 there is provided the pair of rollers 8, 9 for driving the web 7 in the correct manner.

The advantages of the apparatus described hereinbefore consist in particular of the various measures taken for eliminating the stretch which may occur during printing of a web of non-woven material. In connection therewith, the somewhat increased slip-drive of the support rollers 5 and the curved shape of the printing and drying paths are important.

#### WHAT WE CLAIM IS:—

1. Apparatus for printing a web of non-woven material provided with two or more driven rotary printing units each co-operating with a respective support roller positioned opposite thereof, and a feeder for the material to be printed, wherein the web of material is, during operation of the apparatus, carried directly by the support rollers which are provided with a slip drive having a velocity which exceeds the circumferential velocity of the printing units by 0.5 to 1%.

2. Apparatus as claimed in Claim 1, wherein two contact zones of successive support rollers with the respective printing

units constitute the bending points of a curved guide path of the web of material to be printed, which path is concave with respect to the said rollers.

3. Apparatus as claimed in Claim 2, further comprising a drying chest for the printed web of material, wherein the printing units are arranged according to two paths which extend generally vertically and the drying chest is located thereabove along a substantially horizontal path.

4. Apparatus as claimed in Claim 3, wherein inside the drying chest are a number of guide rollers so arranged as to form an upwardly convex bent path for the web to be dried.

5. Apparatus as claimed in any of Claims 1 to 4, wherein the slip drive for the support rollers comprises an endless belt with a drive, which belt is slung over a part of the circumference of respective pulleys each mounted adjacent a said support roller.

6. Apparatus as claimed in Claim 5, wherein the drive of the endless belt is so coupled to a pair of rollers for the supply of a web of material to be printed that the said pair of rollers has a tangential velocity which exceeds the velocity of the printing units by 0.1 to 0.4%.

7. Apparatus as claimed in any of Claims 1 to 6, wherein the said printing units are screen stencils or intaglio rollers.

8. Apparatus for printing a web of non-woven material, substantially as herein described with reference to, and as shown in, the accompanying drawings.

9. A method of printing a web of non-woven material, by means of two or more stations each provided with a driven rotary printing unit, wherein the web of material in each printing station is supported directly by a respective driven support roller in which, via a slip drive, each said roller is given a circumferential velocity which exceeds the circumferential velocity of the respective printing units by 0.5 to 1%.

10. A method as claimed in Claim 9, wherein the said material printed is paper.

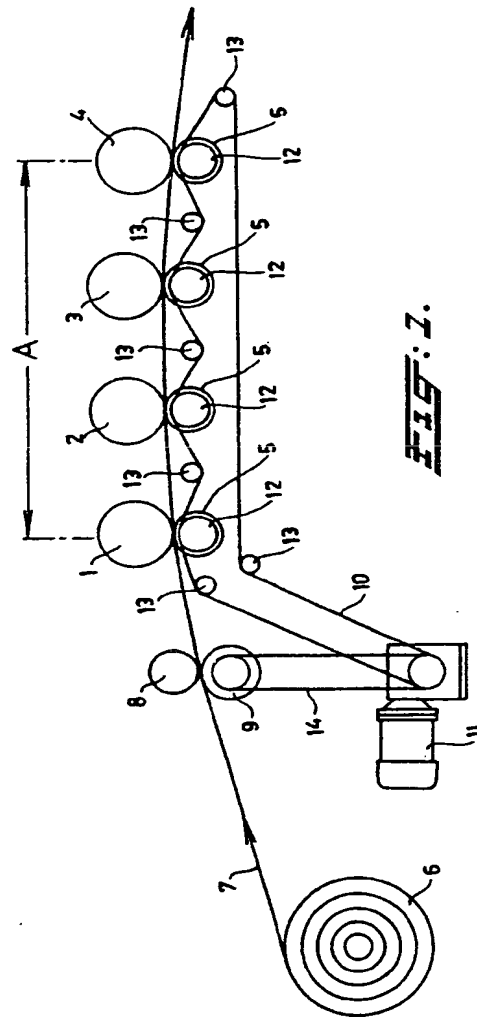
11. A method of printing a web of non-woven material, substantially as herein described with reference to the accompanying drawings.

12. A web of non-woven material printed by the method as claimed in any of Claims 9 to 11.

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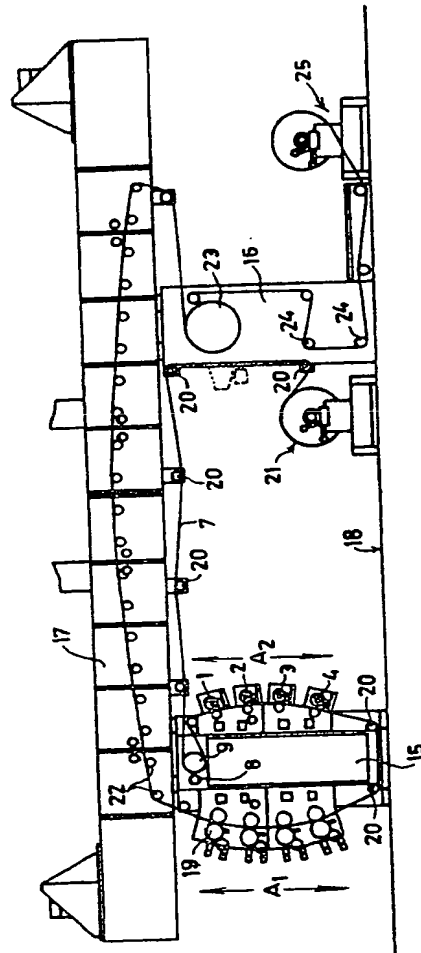


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**FIG. 2.**